Space Weather Technical Forecast

Issued on Tuesday, 01 November 2022 at 13:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storms 03 and 04 November. Ongoing Active electron fluence.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low over the last 24 hours, with minor low energy C-class flares observed. There are currently five active regions on the visible disc. AR3131 (Hhx/Alpha) and AR3135 (Esi/Beta) are the most mature and largest regions, although AR3136 (Cri/Beta) has recently developed in the southeast quadrant and has developed in complexity. The remaining spots are unnumbered and relatively weak. No Earth-directed coronal mass ejections have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, observed by DSCOVR at L1, has followed a slightly declining trend from averaging 500km/s to around 430km/s. This is indicative of the waning fast wind of coronal hole 37. Density was around average. Total interplanetary magnetic field strength was weak below 7nT throughout. The north-south component, Bz, also varied weakly. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was mainly Quiet to Unsettled (Kp 2-3) with one Active interval between 31/1500-1800UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at mostly high levels, with a peak of 4920pfu at 31/1755 UTC, but fell to moderate levels between 31/2100 to 01/1200 UTC, just recently increasing back above the high threshold. Electron fluence levels were above the Active threshold with a peak value of 1.58e8 integrated pfu observed at 31/2400 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is likely to be Low or Very Low, with a very slight, but increasing, chance of isolated Moderate activity.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. The Earth is currently under the influence of a waning high speed stream from coronal hole 37, with the HSS from coronal hole 38 also due to connect on 01 November, speeds perhaps reaching 500km/s. This HSS is then forecast to wane later on 02 November, with a connection with the HSS from coronal hole 39 due on 04 November, speeds likely to be in the range of 500-600km/s. Geomagnetic activity is forecast to be mainly Unsettled with a very slight chance of Active or G1/Minor Storm intervals. Mainly Quiet to Unsettled activity expected on 02 and much of 03 November. There is a chance of Active to G1/Minor Storms either late on 03 or during 04 November due to the connection with the HSS.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at moderate to high levels. The associated 24 hour electron fluence is expected to continue just above the Active (1e8 integrated pfu) threshold.

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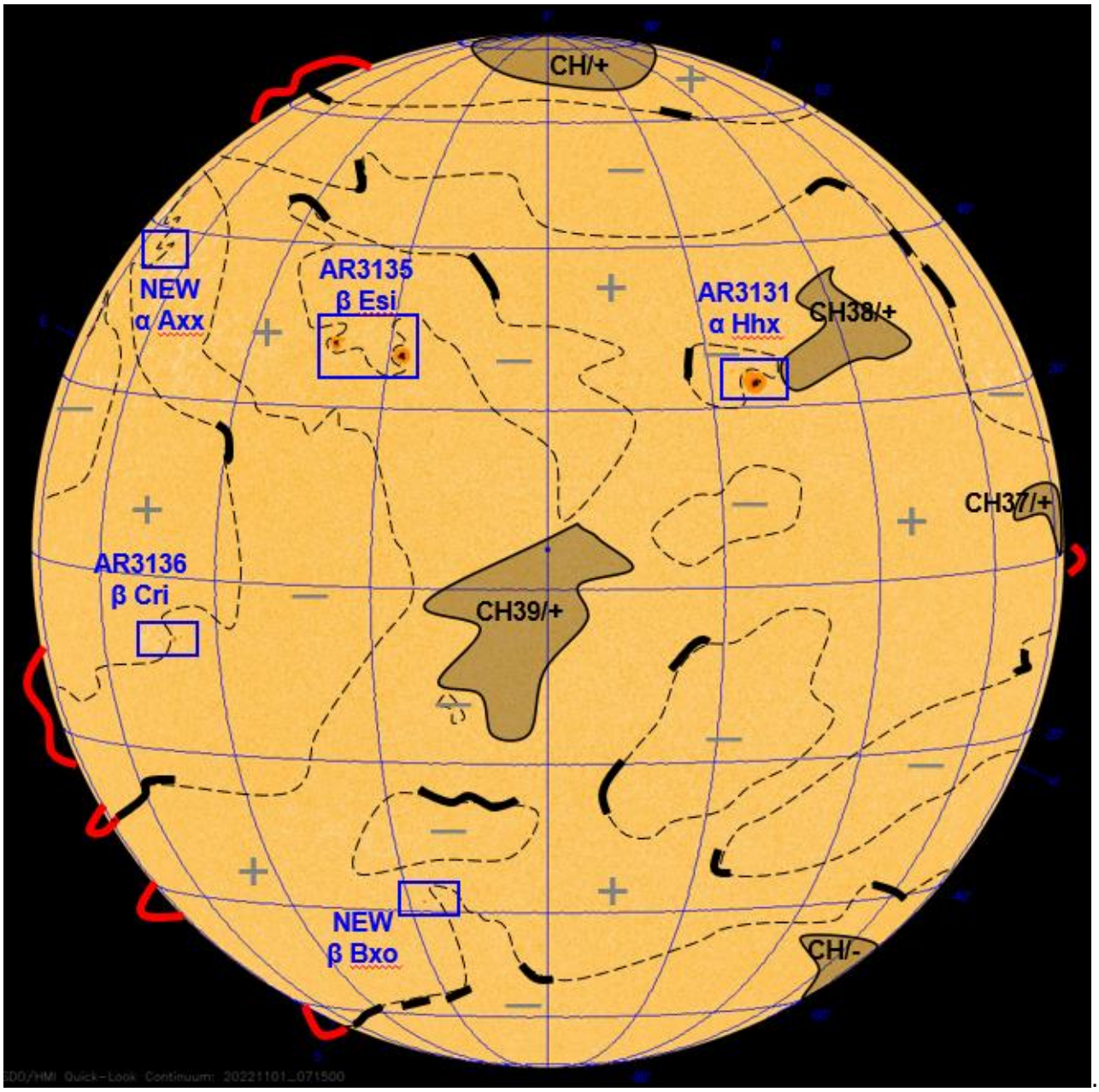
Figure 1. Solar Analysis Valid 01/0715UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth directed CMEs are forecast. A filament eruption from the eastern hemisphere of the Sun late on 31 October, has been modelled by Enlil and is forecast to miss the Earth.

Earth is currently under the waning influence of the high speed stream (HSS) from coronal hole 37 which is now close to the western limb. The HSS from coronal hole 38 is due to connect with the Earth on 01 November. This feature then likely to remain connected until late on 02 November. Speeds are expected to be in the region of 500km/s, as this is a recurrent, but weaker feature, than on the last rotation. A slight decline in speeds is then anticipated on 03 November, before the HSS from coronal hole 39 is due to connect either late on 03 or into 04 November with speeds of 500-600km/s forecast, based on persistence.

Geomagnetic activity is forecast to be mainly Unsettled on 01 November, with isolated Active intervals and a very slight chance of G1/Minor Storms. Quiet to Unsettled on 02 November, then Unsettled to Active 03 or 04 November with a chance of G1/Minor Storms due to the connection with the next coronal hole high speed stream.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	20	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: L1/DSCOVR 24 hour data showing the solar wind environment.

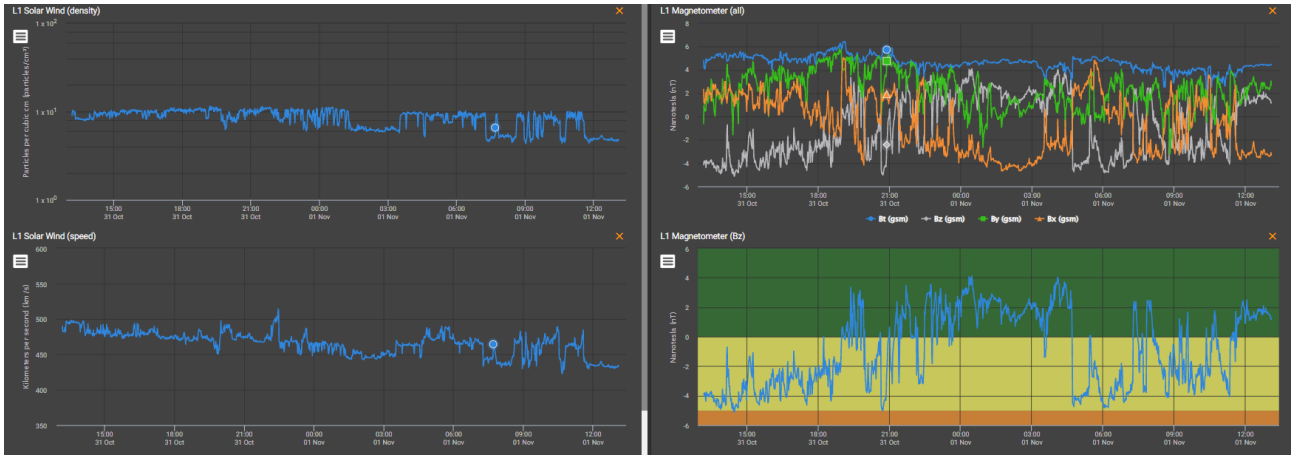

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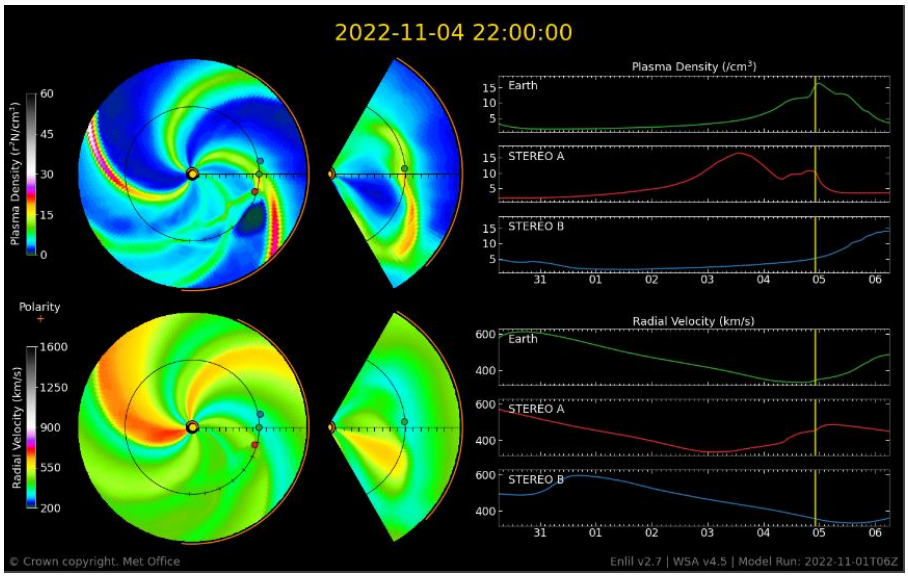
Figure 3: MOSWOC Enlil, showing the modelled CME from 31 October passing the Earth



Radio Blackouts - X-Ray Flares:

There are two significant sunspots on the visible disc, AR3131 in the northwest quadrant and AR3135 in the northeast. Both these are relatively simple but mature regions. AR3136 in the southeast has developed noticeably over the last 24 hours. The remaining regions are all simple and stable or are only developing slowly.

There are a number of bright flux areas due to rotate onto the visible disc through the next four days, with a steadily increasing risk of M-class flaring.

Solar activity is expected to be mainly Low or Very Low with a slight but increasing chance of Moderate activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	10	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

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Met Office Space Weather Technical Forecast

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background and is forecast to remain at this level through the guidance period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to continue at moderate to high levels through much of the period. There is a risk of brief declines due to strong high speed streams deforming the radiation belts away from their natural orbits, but an increase should then be observed as the belts relax.

The electron fluence values are expected to remain above the Active threshold (1e8 integrated pfu) for much of the period in the presence of coronal hole high speed streams which will provide a consistent source of additional electrons. The overall fluence is unlikely to be significantly affected by brief declines in flux and should remain above the Active threshold in the absence of significant geomagnetic activity.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	80	70	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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